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## 1 Deep shadow maps

Tom Lokovic, Eric Veach

July 2000 **Proceedings of the 27th annual conference on Computer graphics and interactive techniques**Full text available: [pdf\(783.65 KB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We introduce deep shadow maps, a technique that produces fast, high-quality shadows for primitives such as hair, fur, and smoke. Unlike traditional shadow maps, which store a single depth at each pixel, deep shadow maps store a representation of the fractional visibility through a pixel at all possible depths. Deep shadow maps have several advantages. First, they are prefiltered, which allows faster shadow lookups and much smaller memory footprints than regular shadow maps ...

## 2 Efficient simulation of light transport in scenes with participating media using photon maps

Henrik Wann Jensen, Per H. Christensen

July 1998 **Proceedings of the 25th annual conference on Computer graphics and interactive techniques**Full text available: [pdf\(10.04 MB\)](#)Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** anisotropic scattering, global illumination, light transport, multiple scattering, nonhomogeneous media, participating media, photo-realism, photon map, photon tracing, ray marching, rendering, volume caustics

## 3 The RADIANCE lighting simulation and rendering system

Gregory J. Ward

July 1994 **Proceedings of the 21st annual conference on Computer graphics and interactive techniques**Full text available: [pdf\(2.36 MB\)](#)Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper describes a physically-based rendering system tailored to the demands of lighting design and architecture. The simulation uses a light-backwards ray-tracing method with extensions to efficiently solve the rendering equation under most conditions. This

includes specular, diffuse and directional-diffuse reflection and transmission in any combination to any level in any environment, including complicated, curved geometries. The simulation blends deterministic and stochastic ray-trac ...

**Keywords:** Monte Carlo, lighting simulation, physically-based rendering, radiosity, ray-tracing

**4** 3D texture: Shell texture functions

Yanyun Chen, Xin Tong, Jiaping Wang, Stephen Lin, Baining Guo, Heung-Yeung Shum  
August 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 3

Full text available:  [pdf\(1.40 MB\)](#)  Additional Information: [full citation](#), [abstract](#), [references](#), [mov\(16:45 MIN\)](#)

We propose a texture function for realistic modeling and efficient rendering of materials that exhibit surface mesostructures, translucency and volumetric texture variations. The appearance of such complex materials for dynamic lighting and viewing directions is expensive to calculate and requires an impractical amount of storage to precompute. To handle this problem, our method models an object as a shell layer, formed by texture synthesis of a volumetric material sample, and a homogeneous inne ...

**Keywords:** BTF, Texture mapping, mesostructure, reflectance and shading models, subsurface scattering, texture synthesis

**5** Distributed ray tracing

Robert L. Cook, Thomas Porter, Loren Carpenter  
January 1984 **ACM SIGGRAPH Computer Graphics , Proceedings of the 11th annual conference on Computer graphics and interactive techniques**, Volume 18 Issue 3

Full text available:  [pdf\(909.54 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Ray tracing is one of the most elegant techniques in computer graphics. Many phenomena that are difficult or impossible with other techniques are simple with ray tracing, including shadows, reflections, and refracted light. Ray directions, however, have been determined precisely, and this has limited the capabilities of ray tracing. By distributing the directions of the rays according to the analytic function they sample, ray tracing can incorporate fuzzy phenomena. This provides c ...

**Keywords:** Camera, Constructive solid geometry, Depth of field, Focus, Gloss, Motion blur, Penumbra, Ray tracing, Shadows, Translucency, Transparency

**6** Multi-pass pipeline rendering: realism for dynamic environments

Paul J. Diefenbach, Norman I. Badler  
April 1997 **Proceedings of the 1997 symposium on Interactive 3D graphics**

Full text available:  [pdf\(1.38 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**7** Plants: Real-time rendering of plant leaves

Lifeng Wang, Wenle Wang, Julie Dorsey, Xu Yang, Baining Guo, Heung-Yeung Shum  
July 2005 **ACM Transactions on Graphics (TOG)**, Volume 24 Issue 3

Full text available:  [pdf\(941.75 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#)

This paper presents a framework for the real-time rendering of plant leaves with global

illumination effects. Realistic rendering of leaves requires a sophisticated appearance model and accurate lighting computation. For leaf appearance we introduce a parametric model that describes leaves in terms of spatially-variant BRDFs and BTDFs. These BRDFs and BTDFs, incorporating analysis of subsurface scattering inside leaf tissues and rough surface scattering on leaf surfaces, can be measured from rea ...

**Keywords:** appearance modeling, natural phenomena, real-time rendering, reflectance and shading models

**8 Session P3: volume visualization I: Interactive spectral volume rendering**

Steven Bergner, Torsten Möller, Mark S. Drew, Graham D. Finlayson

October 2002 **Proceedings of the conference on Visualization '02**

Full text available:  [pdf\(5.23 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We describe a method for volume rendering using a spectral representation of colour instead of the traditional RGB model. It is shown how to use this framework for a novel exploration of datasets through enhanced transfer function design. Furthermore, our framework is extended to allow real-time re-lighting of the scene created with any rendering method. The technique of post-illumination is introduced to generate new spectral images for arbitrary light colours in real-time. Also a tool is descr ...

**Keywords:** interactive re-lighting, post-illumination, spectral volume rendering

**9 A volume density optical model**

Peter L. Williams, Nelson Max

December 1992 **Proceedings of the 1992 workshop on Volume visualization**

Full text available:  [pdf\(807.78 KB\)](#)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**10 A rendering algorithm for visualizing 3D scalar fields**

Paolo Sabella

June 1988 **ACM SIGGRAPH Computer Graphics , Proceedings of the 15th annual conference on Computer graphics and interactive techniques**, Volume 22 Issue 4

Full text available:  [pdf\(3.86 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper presents a ray tracing algorithm for rendering 3D scalar fields. An illumination model is developed in which the field is characterized as a varying density emitter with a single level of scattering. This model is equivalent to a particle system in which the particles are sufficiently small. Along each ray cast from the eye, the field is expressed as a function of the ray parameter. The algorithm computes properties of the field along the ray such as the attenuated intensity, the pea ...

**Keywords:** 3D image, light scattering, ray tracing, thresholding

**11 Modeling and rendering of weathered stone**

Julie Dorsey, Alan Edelman, Henrik Wann Jensen, Justin Legakis, Hans Køhling Pedersen  
July 1999 **Proceedings of the 26th annual conference on Computer graphics and interactive techniques**

Full text available:  [pdf\(6.98 MB\)](#)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** erosion, material models, natural phenomena, physical simulation, ray tracing, subsurface scattering, texturing, volume modeling, weathering

**12 A two-pass solution to the rendering equation: A synthesis of ray tracing and radiosity methods**

John R. Wallace, Michael F. Cohen, Donald P. Greenberg

August 1987 **ACM SIGGRAPH Computer Graphics , Proceedings of the 14th annual conference on Computer graphics and interactive techniques**, Volume 21 Issue 4

Full text available:  pdf(2.52 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

View-independent and view-dependent image synthesis techniques, represented by radiosity and ray tracing, respectively, are discussed. View-dependent techniques are found to have advantages for calculating the specular component of illumination and view-independent techniques for the diffuse component. Based on these observations a methodology is presented for simulating global illumination within complex environments using a two-pass approach. The first pass is view-independent and is based on ...

**13 Real-time rendering of translucent meshes**

Xuejun Hao, Amitabh Varshney

April 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 2

Full text available:  pdf(4.66 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Subsurface scattering is important for photo-realistic rendering of translucent materials. We make approximations to the BSSRDF model and propose a simple lighting model to simulate the effects on translucent meshes. Our approximations are based on the observation that subsurface scattering is relatively local due to its exponential falloff. In the preprocessing stage we build subsurface scattering neighborhood information, which includes all the vertices within effective scattering range from ea ...

**Keywords:** BSSRDF, local illumination, reflection models, subsurface scattering

**14 Reflection from layered surfaces due to subsurface scattering**

Pat Hanrahan, Wolfgang Krueger

September 1993 **Proceedings of the 20th annual conference on Computer graphics and interactive techniques**

Full text available:  pdf(707.86 KB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** Monte Carlo, integral equations, reflection models.

**15 Precomputed light transport: All-frequency interactive relighting of translucent objects with single and multiple scattering**

Rui Wang, John Tran, David Luebke

July 2005 **ACM Transactions on Graphics (TOG)**, Volume 24 Issue 3

Full text available:  pdf(465.99 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We present a technique, based on precomputed light transport, for interactive rendering of translucent objects under all-frequency environment maps. We consider the complete BSSRDF model proposed by Jensen et al. [2001], which includes both single and diffuse multiple scattering components. The challenge is how to efficiently precompute all-

frequency light transport functions due to subsurface scattering. We apply the two-pass hierarchical technique by Jensen et al. [2002] in the space of non-li ...

**Keywords:** Haar wavelets, phase function, precomputed radiance transfer, separable approximation, subsurface scattering

**16** Display of the earth taking into account atmospheric scattering

Tomoyuki Nishita, Takao Sirai, Katsumi Tadamura, Eihachiro Nakamae

September 1993 **Proceedings of the 20th annual conference on Computer graphics and interactive techniques**

Full text available:  [pdf\(404.55 KB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** atmospheric scattering, color of water, earth, optical length, photo-realism, radiative transfer, sky light

**17** Session 3: light: Interactive subsurface scattering for translucent meshes

Xuejun Hao, Thomas Baby, Amitabh Varshney

April 2003 **Proceedings of the 2003 symposium on Interactive 3D graphics**

Full text available:  [pdf\(19.67 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We propose a simple lighting model to incorporate subsurface scattering effects within the local illumination framework. Subsurface scattering is relatively local due to its exponential falloff and has little effect on the appearance of neighboring objects. These observations have motivated us to approximate the BSSRDF model and to model subsurface scattering effects by using only local illumination. Our model is able to capture the most important features of subsurface scattering: reflection an ...

**Keywords:** BSSRDF, local illumination, reflection models, subsurface scattering

**18** A framework for realistic image synthesis

Donald P. Greenberg, Kenneth E. Torrance, Peter Shirley, James Arvo, Eric Lafontaine, James A. Ferwerda, Bruce Walter, Ben Trumbore, Sumanta Pattanaik, Sing-Choong Foo

August 1997 **Proceedings of the 24th annual conference on Computer graphics and interactive techniques**

Full text available:  [pdf\(28.94 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**Keywords:** light reflection, perception, realistic image synthesis

**19** Session E: Rendering: Forward area light map projection

Elvis Ko-Yung Jeng, Zhigang Xiang

February 2003 **Proceedings of the 2nd international conference on Computer graphics, virtual Reality, visualisation and interaction in Africa**

Full text available:  [pdf\(1.32 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We present a new method for soft shadow visualization. This two-stage approach generates high-quality soft shadow images by projecting sampled surface points, which are kept in a "layered area light map", onto the viewing screen. The layered area light map is created in the preprocessing stage, and is multi-layered in the sense that each map cell keeps the

visibility ratio of the area light source with respect to multiple surface points at varying depth. In the forward projection stage, we proje ...

**Keywords:** area light, rendering, shadow algorithm, soft shadow

**20 A shading model for atmospheric scattering considering luminous intensity distribution of light sources**

Tomoyuki Nishita, Yasuhiro Miyawaki, Eihachiro Nakamae

August 1987 **ACM SIGGRAPH Computer Graphics , Proceedings of the 14th annual conference on Computer graphics and interactive techniques**, Volume 21 Issue 4

Full text available:  [pdf \(1.96 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Studio spotlights produce dazzling shafts of light, while light scattered from fog illuminated by automobile headlights renders driving difficult. This is because the particles in the illuminated volume become visible by scattering light. A shading model for scattering and absorption of light caused by particles in the atmosphere is proposed in this paper. The method takes into account luminous intensity distribution of light sources, shadows due to obstacles, and density of particles. The inten ...

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